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Aging in the Eighties: The Prevalence of Comorbidity and Its Association With Disability

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Introduction

It is frequently stated that the coexistence of multiple chronic conditions, referred to here as comorbidity, is common in the older population. It is also assumed that comorbidity puts a special burden on older people that affects their overall health status and functional disability. Although these perceptions are supported by the experiences of those providing care to older patients, there has been little work to systematically evaluate the prevalence, specific patterns, and impact of comorbidity in community-dwelling representative older populations.

The prevalence of comorbidity at the time of death has been documented using multiple cause-of-death data from U.S. mortality statistics. In 1979, more than one cause of death was noted on 73 percent of all death certificates, with 33 percent of deaths attributed to two causes, 25 percent to three causes, and 16 percent to four causes or more (1). Multiple cause-of-death data have also been produced for other years and show an increase during this century in the proportion of deaths attributable to more than one cause. More than one cause of death was reported in 35 percent of deaths in 1917, with this percent rising to 60 percent in 1955 and 73 percent in 1979 (1). This increase is likely due to an increase in the average age at death, to fewer deaths resulting from acute, infectious diseases, and to more complete diagnosis and reporting of causes of death.

Using National Health Interview Survey (NHIS) data, Rice and LaPlante (2) evaluated the occurrence of multiple chronic conditions responsible for people's being limited in activity. There were about 1.4 chronic conditions reported in 1969–71 and about 1.6 conditions reported in 1979–81 for each person 65 years of age and older who was limited in activity. The average was higher than for those under age 65, but

[1]Israel RA, Rosenberg HM, Curtin LR. Analytic potential for multiple cause-of-death data. Am J Epidemiol 124:161–79. 1986.

[2]Rice DP, LaPlante MP. Chronic illness, disability, and increasing longevity. In Sullivan S, Lewin ME, eds. The economics and ethics of long-term care and disability. Washington: American Enterprise Institute for Public Policy Research. 1988. pp. 9–55.

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there was no trend with age among those 65 years of age and over.

This report will first present information on the prevalence and coprevalence of nine common chronic conditions in a national sample of persons 60 years of age and older. The impact of comorbidity will then be assessed by estimating the prevalence of disability in activities of daily living according to the number of conditions present.

Materials and methods

The National Health Interview Survey (NHIS) is the National Center for Health Statistics' large continuing survey of the civilian noninstitutionalized population of the United States. Each year, people in about 42,000 households are interviewed by U.S. Bureau of the Census interviewers to obtain information about their health and use of health care. Demographic information that is needed to interpret the data is also obtained. The interviewers have special training for this survey, in addition to their regular training, and response rates are high—about 97 percent. The only item with a relatively low response rate is family income.

In 1984 a special supplement was added to the questionnaire to obtain information about older people who were living in the community (3). This supplement, the Supplement on Aging (SOA), was designed to collect information about chronic conditions, physical limitations, housing, retirement status, interactions with family and organizations, use of community services, and other health-related and social information about people middle-aged and older. All household members 65 years of age and over and a one-half sample of those 55–64 years of age were asked the questions on the supplement themselves when possible. Another household member was interviewed only when the selected person was unable to answer either because of physical or mental problems or because of being away from the household for a longer period than the interviewer would be in the area. Response rates to the SOA were also high; 95 percent of the people selected from the NHIS sample had complete interviews with the SOA. Overall, 91.5 percent of the SOA sample responded for themselves. There were 16,148 persons interviewed in the SOA. The analyses presented here are for the 13,807 individuals 60 years of age and older, representing an estimated 37.3 million noninstitutionalized persons in this age range in the United States in 1984.

All estimates in this report are based on the national estimates. All estimated variances and tests of significance take the complex sample design into account. The authors have taken care not to make statements about differences unless it is likely that the same differences would be found using the same techniques in a complete census.

The list of chronic conditions used in the SOA was designed by selecting those conditions most prevalent among older people from the condition lists on the NHIS. Each participant was asked whether he or she had each condition. For 13 conditions, participants were asked if they had ever had the condition. For 5 conditions (arthritis, diabetes, aneurysm, blood clots, and varicose veins), participants were asked if they had the condition in the past 12 months. For the purpose of this report, the cataract category includes those saying they currently have a cataract, have had surgery for a cataract, or have had a lens implant for a cataract. Heart disease was considered present in those who reported they had ever had coronary heart disease, angina pectoris, a myocardial infarction, or any other heart

[3]Fitti JE, Kovar MG. The supplement on aging to the 1984 National Health Interview Survey. National Center for Health Statistics. Vital Health Stat. 1(21). 1987.

attack. Osteoporosis and hip fracture were combined into one category.

The prevalence of comorbidity is related to the length of the list of possible comorbid conditions. For the purpose of the analyses in this report, only nine common chronic conditions are considered. A longer list of conditions would obviously lead to a higher prevalence of comorbidity. One of the methodologic problems that makes the study of specific patterns of comorbidity difficult is that the number of combinations of conditions can grow very large. Even using this restricted list of 9 common conditions, there are 36 possible pairs of co-occurring conditions. If rarer conditions were included, the number of possible combinations would be much larger and the number of people in each cell would become too small for useful analysis.

If two conditions are independent, their expected coprevalence is the product of their individual prevalence rates. For example, the expected coprevalence of arthritis and hypertension is $(.490)(.418)(100) = 20.5$ percent. The observed coprevalence of two conditions was compared with the expected coprevalence, which was calculated on the assumption of independence of the conditions. The percent difference was calculated using the formula:

$$((\text{Observed} - \text{Expected})/\text{Expected}) \times 100$$

The SOA included questions on six activities of daily living (ADL): bathing or showering, dressing, eating, getting in and out of bed or a chair, walking, and using the toilet. Participants were first asked if they had difficulty performing each of these activities. Those reporting difficulty were then asked how much difficulty and whether they received help from another person. This report provides information, according to the number of chronic conditions, on the proportion of people who have difficulty with one or more of these activities and the proportion receiving help from another person to perform one or more of the activities. Because the questions on ADL's were asked separately from the questions on chronic conditions, the reader should not infer that these are necessarily the conditions that cause the ADL difficulty.

Prevalence of chronic conditions

The prevalence of the nine common self- or proxy-reported chronic conditions or groups of conditions in those 60 years of age and older that are considered in these analyses are shown in the following list. (Alzheimer's disease was on the list; but because less than 0.5 percent of respondents or their proxies reported this condition, it was not included in these analyses.)

Condition	Percent of population
Arthritis	49.0
Hypertension	41.8
Cataracts	19.9
Heart disease	14.0
Varicose veins	9.9
Diabetes	9.5
Cancer (except nonmelanoma skin cancer)	6.6
Osteoporosis or hip fracture	5.5
Stroke	5.4

Prevalence of comorbidity

The proportion of the population with none of the nine chronic conditions or with four or more was higher than would have been expected by chance (table 1).

The proportion of the population 60 years of age and older with two or more of the nine chronic conditions under consideration was higher at each older age and, for each age group, was higher for women than for men (figure 1).

Table 1. Proportion of population observed and expected to have the specified number of chronic conditions, and ratio of observed to expected: United States, 1984

Number of conditions	Observed percent	Expected percent	Ratio of observed to expected
0	21.2	13.9	1.53
1	30.1	34.7	0.87
2	25.9	32.3	0.80
3	14.6	14.7	0.99
4	6.0	3.7	1.62
5 or more	2.3	0.6	3.83

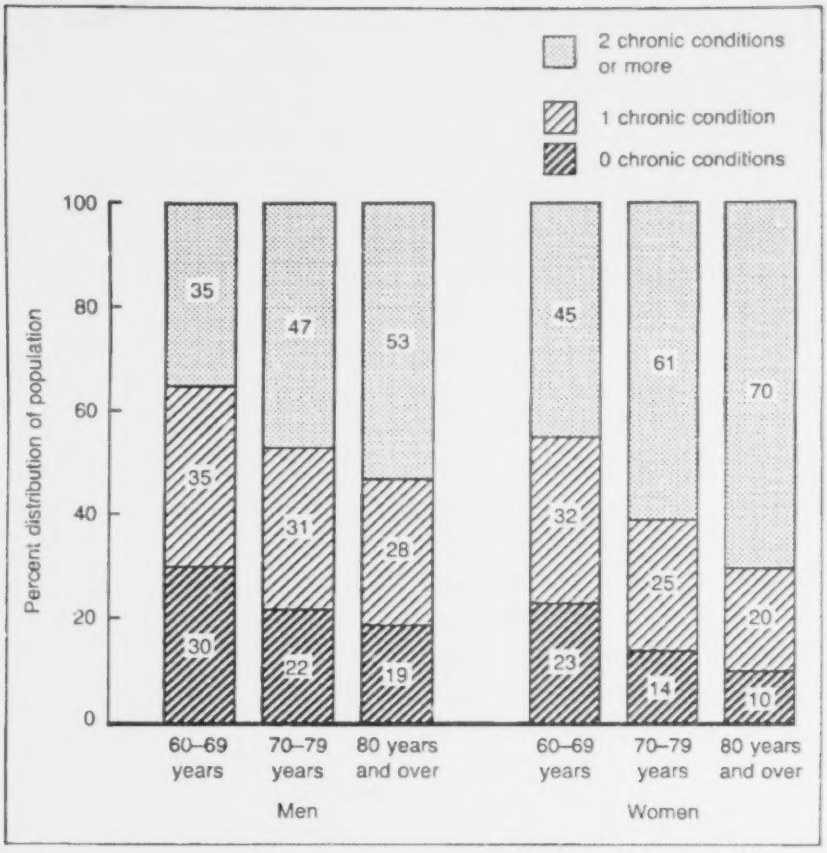

Figure 1. Percent distribution of population 60 years of age and over by number of chronic conditions, according to age group and sex: United States, 1984

For those 80 years of age and older, 70 percent of the women and 53 percent of the men had two or more of the nine conditions. The prevalence of the eight most commonly occurring pairs of comorbid conditions is shown in figure 2. Prevalence of comorbidity for a pair of conditions is very much related to the prevalence of each of the individual conditions. High blood pressure and arthritis, the two conditions with the highest prevalence, co-occurred in 24.1 percent of those 60 years of age and older; cataract and arthritis were both reported by 11.7 percent. The remaining six pairs of common comorbid conditions had coprevalences of 5–10 percent. In each case, for the eight most common pairs of conditions, there was an increase in observed comorbidity over expected comorbidity in people 60 years of age and older (figure 3). All increases, except for cataract with high blood pressure in men, were statistically significant at $p < .001$ in analyses that adjusted for the complex sampling design. Analyses of specific age groups show similar relationships.

Relationship of comorbidity with disability

The percent of men and women having difficulty or receiving help with ADL's, by number of chronic conditions, is shown in figure 4. There is a clear, graded increase in the proportion with disability of those with none of the nine conditions to those with five or more of the conditions. There is no consistent difference between men and women (within each stratum) of number of conditions. Since age and gender are related to the prevalence of comorbidity, data are presented for three separate age groups for men and women (figures 5 and 6; table 2). Again, within each age group there is a systematic increase in the percent with disability in ADL's with increasing numbers of conditions. Looking across age groups for a specific number of conditions, there is also, in general, a graded increase in disability with increasing age.

Discussion

Analysis reveals that, using this list of nine commonly reported chronic conditions, the prevalence of comorbidity is substantial. High rates of comorbidity are seen for women, with prevalence rates rising from 45 percent in the age group 60–69 years to 70 percent in those 80 years of age and older.

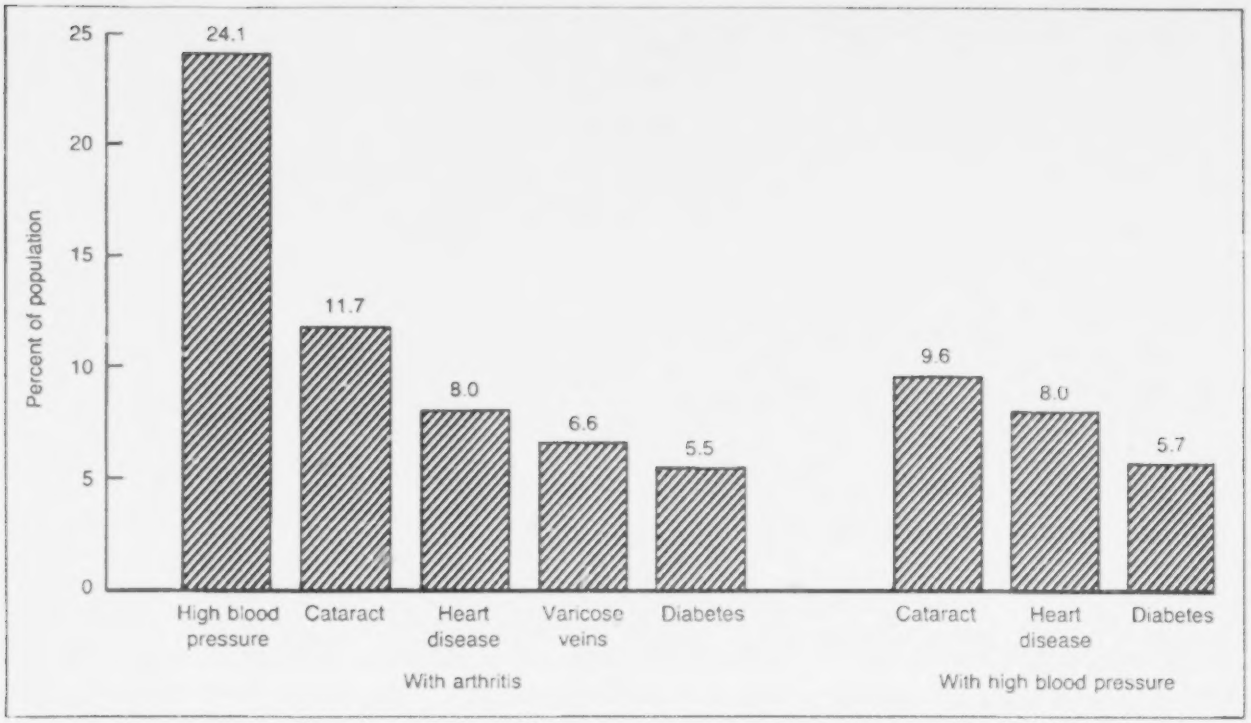

Figure 2. Prevalence of most common comorbid conditions among people 60 years of age and over: United States, 1984

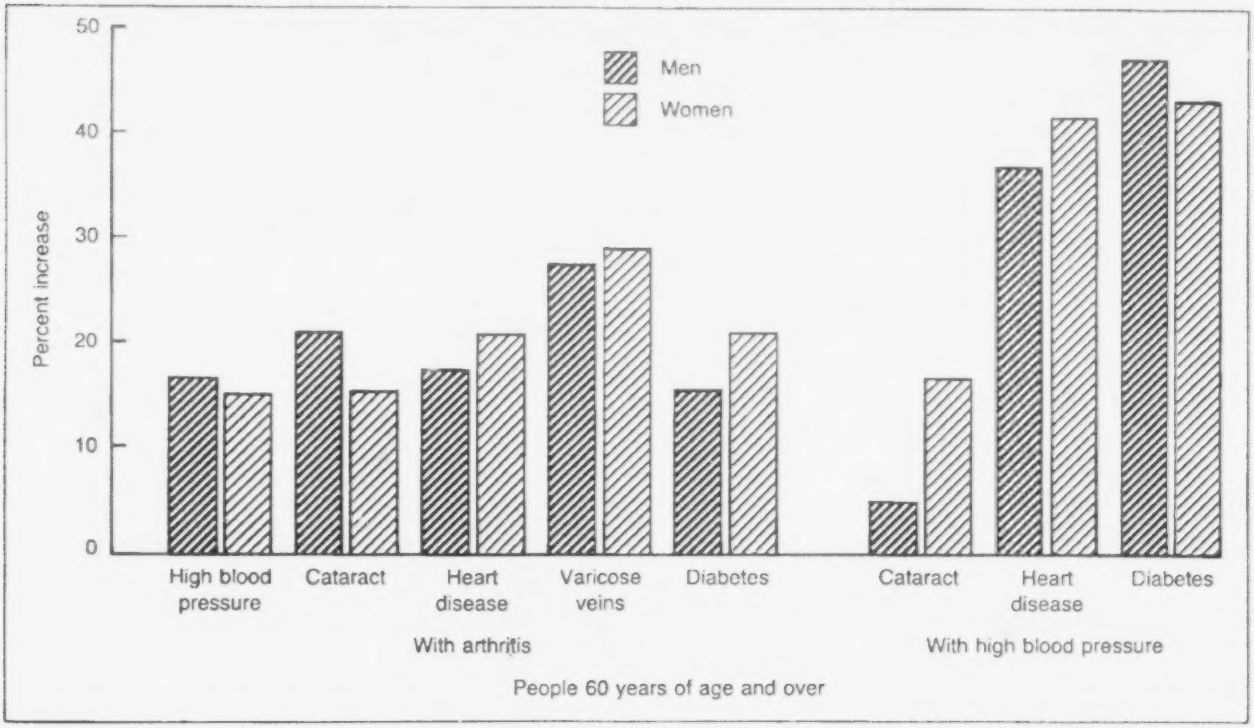

Figure 3. Percent increase in observed over expected frequency of most common comorbid conditions among men and women 60 years of age and over: United States, 1984

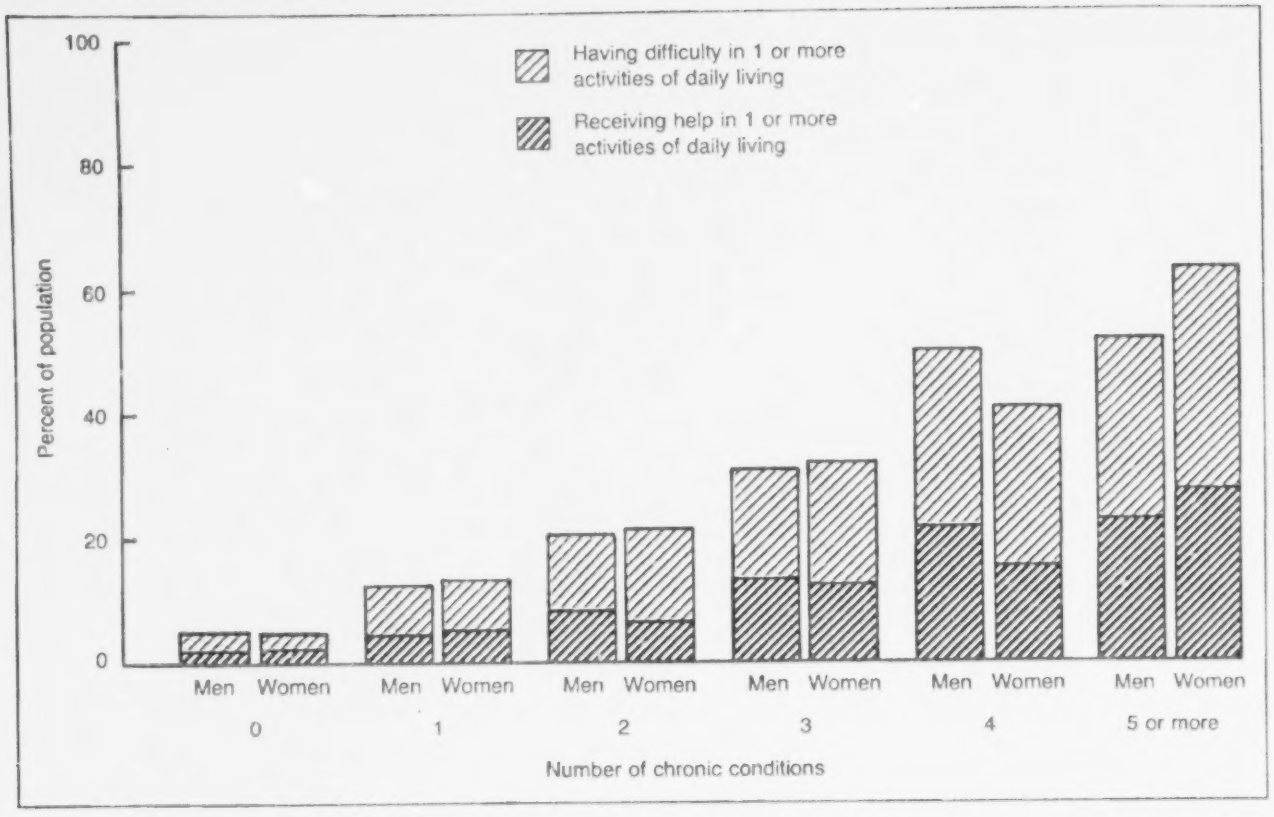

Figure 4. Age-adjusted prevalence of men and women 60 years of age and over having difficulty and receiving help in 1 or more activities of daily living, by number of chronic conditions: United States, 1984

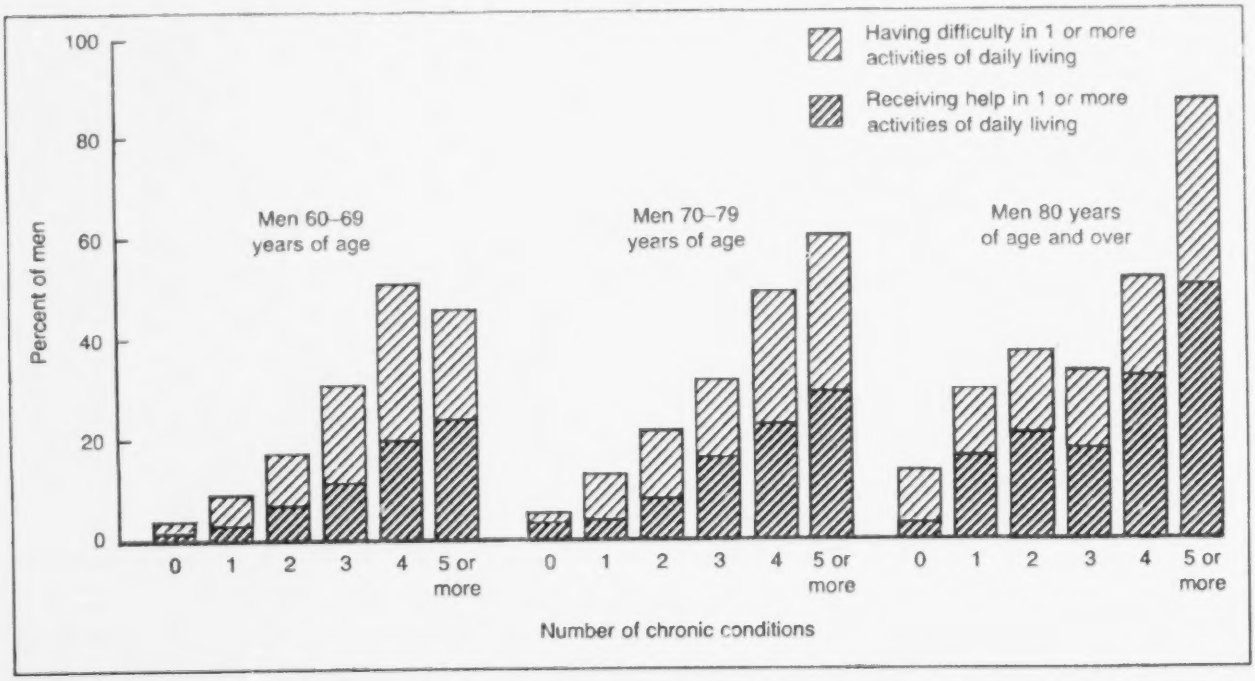
Having difficulty in 1 or more activities of daily living
Receiving help in 1 or more activities of daily living
Percent of men
100
80
60
40
20
0
Men 60–69 years of age
Men 70–79 years of age
Men 80 years of age and over
0 1 2 3 4 5 or more
Number of chronic conditions

Figure 5. Prevalence of men 60 years of age and over having difficulty and receiving help in 1 or more activities of daily living, by number of chronic conditions and age group: United States, 1984

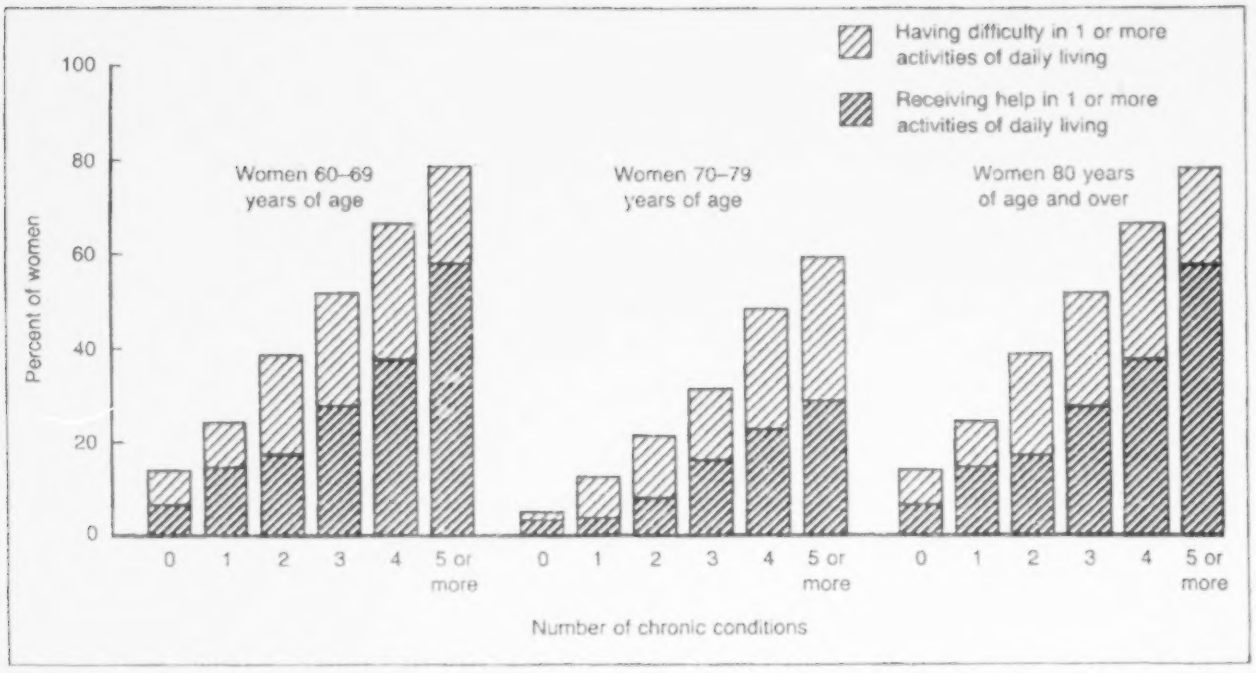
Having difficulty in 1 or more activities of daily living
Receiving help in 1 or more activities of daily living
Women 60–69 years of age
Women 70–79 years of age
Women 80 years of age and over
Percent of women
100
80
60
40
20
0
0 1 2 3 4 5 or more
0 1 2 3 4 5 or more
0 1 2 3 4 5 or more
Number of chronic conditions

Figure 6. Prevalence of women 60 years of age and over having difficulty and receiving help in 1 or more activities of daily living, by number of chronic conditions and age group: United States, 1984

Table 2. Percent of persons 60 years of age and over receiving help and having difficulty with 1 or more activities of daily living, by number of chronic conditions, sex, and age: United States, 1984

Sex and age	Number of conditions					
	0	1	2	3	4	5 or more
Men	Percent of population receiving help					
Age adjusted	2.1	4.8	8.6	13.4	22.0	23.0
60–69 years of age	1.3	2.9	6.3	10.7	19.1	23.3
70–79 years of age	3.2	3.4	7.7	15.7	22.2	28.5
80 years of age and over	2.9	15.7	20.2	17.0	31.4	49.8
Women						
Age adjusted	2.3	5.7	6.9	12.7	15.7	27.7
60–69 years of age	1.4	3.9	4.2	10.1	12.0	21.0
70–79 years of age	2.2	5.2	7.6	11.1	17.5	28.5
80 years of age and over	6.5	14.4	16.9	27.4	37.5	58.1
Men	Percent of population having difficulty					
Age adjusted	5.4	12.8	20.9	31.3	50.6	52.3
60–69 years of age	3.6	8.9	16.9	30.4	50.4	45.2
70–79 years of age	5.2	12.5	21.1	31.2	48.7	59.9
80 years of age and over	13.3	29.2	36.6	32.7	51.5	87.0
Women						
Age adjusted	5.2	13.7	21.7	32.3	41.4	63.7
60–69 years of age	3.0	10.5	17.0	26.8	33.9	60.6
70–79 years of age	5.2	14.7	22.6	33.3	47.1	58.4
80 years of age and over	14.0	24.4	38.8	52.0	66.9	79.2

*U. S. GOVERNMENT PRINTING OFFICE:1989-241-291:80026

For the most commonly reported pairs of comorbid conditions, the observed coprevalence is consistently higher than the expected coprevalence. It was anticipated that high blood pressure and heart disease would co-occur at higher rates than expected from their individual prevalence rates because hypertension is a known risk factor for coronary heart disease. Likewise, high blood pressure and diabetes share an underlying risk factor, overweight, and it was anticipated that they would co-occur at higher rates than expected from their independent distributions. For the other six pairs of conditions, however, their rate of co-occurrence,

ranging from 15 to 30 percent higher than expected, was not anticipated. While this is a modest increase in observed versus expected comorbidity, its impact on the total number of older Americans with specific patterns of comorbidity is substantial. For high blood pressure with arthritis, for example, the independent distributions of these two conditions would predict that 7.6 million persons 60 years of age and older were living in the community with these two conditions. The estimate from the SOA is that there were 9.0 million persons with this pair of conditions, about 1.4 million more than expected.

There are a number of possible explanations for the increase in observed versus expected coprevalence for conditions not generally recognized as being associated. Detection bias would likely have some effect, as those with one condition may have more contacts with the medical care system and therefore greater likelihood of being diagnosed with a second condition. Individuals' response patterns to questionnaires may also play a role. Those who acknowledge having one disease may be more likely to acknowledge having other diseases.

Finally, there could be an underlying biological basis for these findings. In some individuals, genetic and environmental factors may increase general susceptibility to disease, resulting in the occurrence of multiple diseases in the later years of life. Assessment of this hypothesis would require a study that uses standardized medical diagnostic procedures and evaluates risk factors for general susceptibility, as evidenced by multiple chronic conditions.

There was a very clear association found in these data between the number of conditions and the proportion of people with disability as assessed by ADL's. This association was present even though no attempt was made to characterize the severity of the conditions, and despite the use of a list of conditions with potentially very different impacts on serious disability (for example, varicose veins and stroke). While these are important limitations, the number of conditions appears to offer a useful measure of the burden of illness on the older individual, as judged by associated disability.

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